

## Danielle A. Becker, MD, MS

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February 3, 2021

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Mr. Gilligan:

Thank you for allowing me to review the case of Holcombe et al., Morgan Harris Plaintiff vs. The United States of America, defendant. In the preparation of this letter, I had the opportunity to review the following items pertaining to this case listed below.

I have been asked to render my opinions as a physician trained in neurological medicine with an expertise in Neurology. I am currently employed as the Medical Director of Epilepsy at the MetroHealth Hospital Systems and as an Associate Professor of Clinical Neurology at Case Western Reserve University School of Medicine. Until 9/1/2020, I was previously employed as an Assistant Professor of Clinical Neurology at the Perelman School of Medicine at the University of Pennsylvania, where I was in my 7<sup>th</sup> year on the faculty. I was the associate director for the neurology residency and the medical student clerkship. As an attending physician, I frequently supervised fellows, residents, interns, and medical students and now also supervise nurse practitioners. I continue to collaborate with consulting physicians in the care of my patients with various neurological issues. Prior to going to medical school, I completed a Master's degree and part of a doctoral program in psychology with a focus in neuropsychology. For further information about my qualifications, please refer to my curriculum vita.

### **Case Materials Reviewed:**

Aidia Individualized Care  
Dr. Shriner Office notes  
Neurology Institute of San Antonio EMG  
Willingham Report 1.16.20 Ms. Morgan Harris  
Willingham Report 2.25.20. Mr. Kris Workman (Brother-in-law)  
Wilkerson Report  
Neurosurgical Assoc of SA  
Neurology Institute of SA  
Quicksilver Scientific, Inc  
Depo Transcript Harris Morgan 2020.05.21

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Dr. Conolly's Neuropsychological Assessment

South Texas Radiology Imaging Centers

Dr. Pat Lincoln Office notes

Magenta Health records

Dr. Ticknor report

### **Summary of case:**

Ms. Morgan Harris was involved in the mass shooting at the First Baptist Church in Sutherland Springs, Texas, on 11/5/2017. She was working the AV equipment for the church and was behind a temporary wall when she was shot in the left leg, proximal 1/3 calf without an exit wound and again in the distal medial third of the femur with an exit wound roughly 4 inches superior to the entry. She also suffered shrapnel injuries to the right upper extremity, the right anterior chest wall and face. She was transported to Connelly ED, and then transferred to University hospital level III trauma center. There she had a CT on 11/5/2017 with no evidence of intraarticular shrapnel with an intact vascular system. There was no neurovascular injury on assessment. It was determined not to debride or attempt direct shrapnel removal owing to the multiplicity of small fragments spread in surrounding tissues. She was discharged home ambulating on crutches for three weeks. She moved to a single point cane for 2 weeks and then returned to work in January 2018. She denied motor or sensory disturbance in either lower extremity during the initial 8-10 weeks following the injury. By February 2018, she began tripping and falling with a worsening gait pattern. The chiropractor intermittently treated her at work and she saw her PCP, Dr. Rodriguez. In May 2018, she saw Dr. Gazada who completed a neurologic work up for bilateral foot drop and found elevated blood lead levels and incidentally an Arnold Chiari Malformation with profound hydrocephalus was found on subsequent imaging. AFOs were prescribed in June, and she continues to wear them. She has been evaluated by two neurosurgeons who both recommended placement of a VP shunt to treat her profound hydrocephalus. She does endorse symptoms prior to the injury that are attributed to the Arnold Chiari Malformation including neck, hip pain, numbness of the right torso, and low back pain. She managed her pain with conservative care primarily at the chiropractor's office. She now endorses bilateral foot drop and cognitive complaints that she has been told are related to lead toxicity from retained bullet fragments. She did undergo chelation therapy for lead toxicity in February 2019 and stopped July 2019 with some improvement.

### **Records reviewed:**

#### Significant past medical history per various office notes:

Prior to her injury she was a martial arts head instructor (2016-2017), instructor from 2011-2017.

MVA – she hit stopped car

Concussion at age 17 (2008)– punched in head/whiplash, no loss of consciousness, memory loss for 1.5 hours.

Neck and back pain – went to chiropractor (neck pain endorsed in teen years)

Neck injury 2015 – thought it was a pinched nerve

History of a few years ago having intermittent numbness unilaterally on the right side (Prior to shooting)

#### Dr. Suzanne K Gazda office notes

#### 6/21/2018 Dr. Suzanne K Gazda office note:

Ms. Harris was shot in the left leg with shrapnel injury in that extremity as well as in her right upper torso and neck in 11/2017. In December 2018 she noticed weakness in her lower extremities and subsequently developed over the next few months a bilateral foot drop.

Complaints:

- Severe low back pain, radiating into her hips. Comes and goes

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- Bilateral foot drop and generalized weakness in both legs
- Knee pain
- Gait imbalance related to foot drop. Developed on the left and then developed on right foot.
- In 2016 she started having right sided numbness. Total right sided numbness, not isolated to arm.

*Exam:*

*MOTOR:* Shows normal strength and tone in all extremities. There is no atrophy, fasciculations, or tremor. She has a bilateral foot drop.

*STATION AND GAIT:* Intact with normal heel and toe walk, and normal tandem walk. No drift on Romberg is noted.

*REFLEXES:* Reflexes are 2+ and symmetrical.

*SENSATION:* Normal pinprick, light touch, vibration sense in all extremities

### 10/16/2018 Dr. Suzanne K Gazda office note:

Anniversary of the Sutherland Springs massacre. She states she is handling things well. She has strong support from her boyfriend, her church, and her family, etc. She feels that overall her bilateral foot drop is relatively stable, but it has definitely progressed over the last six to eight months. She also has distal paresthesias, but no severe neuropathic pain. Her upper extremities are not involved.

### 12/13/2018 Dr. Suzanne K Gazda office note:

It was noted that Ms. Harris had not developed any new symptoms. Her primary symptoms were 1). Bilateral foot drop. 2). Distal neuropathic pain in her feet, numbness in the soles of her feet. 3). Mild intermittent tremor.

*Exam:*

*Mental status:* Affect is appropriate with normal mood and no mood lability. Thought processes are goal directed. The patient relates a clear history. Thought content is devoid of delusions or hallucinations. Intelligence is normal for age and educational level. Sensorium is clear. The patient is oriented to time, place, and person. Concentration span and memory skills are intact for both visual and verbal tasks. Judgment and insight are good.

*Motor:* Normal strength and tone. No atrophy, fasciculations, or tremor. She has a bilateral foot drop.

*Gait:* Ambulates with a bilateral foot drop, has some difficulty with heel to toe walk.

*Reflexes:* Reflexes are 2+, although trace at the ankles.

*Sensation:* Moderate decrease in vibratory sensation at the ankles. Has bilateral AFOs on, she has a complete right foot drop (can flicker only) and a near complete left foot drop. She has mild right foot edema but no calf swelling. She exhibits no Homans sign. Her feet are both cold but she has good pulses bilaterally.

*Assessment/Plan:*

Felt to have an Autoimmune Neuropathy. On her visit July 11, 2018, all of her neuropathy lab data was negative, suspected this was autoimmune induced. Surprisingly there is marked hydrocephalus on her CT scan, suggestive of an Arnold Chiari malformation. Believed this was a lead induced demyelinating neuropathy related to retained shrapnel from her injury 11/2017.

Hydrocephalus and syringomyelia: Saw neurosurgeons Dr. Vardiman and Dr. Bogaev who both recommended surgery. Dr. Bogaev did not feel a Chiari decompression would be the best surgery. They recommend a VP shunt.

Quick Silver sent 10/2018: Lead is at the 99.9 percentile, also Strontium is at about the 60th percentile, others Cadmium and Cobalt were below the 50th percentile, on her nutrient elements she is low in magnesium, Zinc, copper, lithium, i.e., it would be beneficial to put her on some essential nutrients. Continue with Dr. Shriner for chelation therapy. Will pursue denied IVIG. Continue Methyl B12 Vitamin support, a goal of B12 level > 600.

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### Dr. Sandra Shriner office notes

#### 11/27/2018 Dr. Shriner office visit note:

Sensory motor distal polyneuropathy

Lead toxicity

Arnold Chiari malformation type 1

Normal pressure hydrocephalus (NPH) – [this is incorrect, opening pressure on LP was elevated at 33].

Summary: Lead-induced sensory motor neuropathy and asymptomatic cervical syrinx other than neck pain and exam showing evidence of myelopathy or central cord syndrome. Has NPH and syringomyelia without any form of decompression.

Head and neck – right restriction C2-3, C3-4 in flexion

Skin – Scars from shrapnel, punctate and both entry and exit wounds on left medial leg -proximal 1/3, medial thigh – distal 1/3.

Gait: bilateral foot slap, genu recurvatum bilaterally with subtle trendelenburg right > left. Ambulates with bilateral AFOS.

Musculoskeletal: atrophy bilateral TA, and gastro soleus complex, intrinsic foot muscles. Normal tone in upper extremities, decreased tone in bilateral foot/ankle.

#### Assessment/Plan:

“CDC has normative data on acute lead toxicity, there is no standard method for determining the chronic load burden. Although her lab values reflect a toxic dose for children, there is a strong temporal association and clinical findings with a lower motor neuropathy. Her severe clinical presentation with lower lead levels, although any lead level is toxic, makes one question her normal innate ability to process and eliminate toxins or diminish her total body burden.”

Genetic testing to rule out deficits in phase I and phase II detoxification process. Improvement in nutritional status.

STARTED CHELATION THERAPY 2/2019.

#### 3/5/2019 Dr. Shriner office visit note:

Polyneuropathy, unspecified

Abnormal lead level in blood

Pain in right and left hip

Foot drop, right and left foot

Toxic effect of lead and its compounds

Chest pain

Underwent lead detoxification

States Ms. Harris has done well and has regained some motion in both her feet. She has not attended therapy formally but has been doing home exercises.

She continues to work.

**“She has discomfort in both hips that awaken her and this is a long-standing problem prior to the shooting.”**

Ambulates with bilateral ankle-foot orthoses and bilateral steppage gait. She also has bilateral genu recurvatum [Deformity in the knee joint/knee hyperextension, so that the knee bends backwards. In this deformity, excessive extension occurs in the tibiofemoral joint. It is more common in women and people with familial ligamentous laxity].

*Exam:* 15 degrees dorsiflexion, 10 degrees plantarflexion, 15 degrees inversion and eversion. Able to wiggle toes. Motor demonstrates non-resistive strength – improved from last exam where she had no motion. Sensation intact

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*Plan:* Continue treatment with succimer and supplements.

Labs: selenium, RBC, magnesium, zinc, calcium, lead.

Labs: lead 2, elevated selenium

### 3/26/19 Dr. Shriner office visit note:

As of 3/24/2019 – off lead chelator.

*Exam:* normal exam with full strength except for: Motor – full 5/5 strength Left lower extremity better than right; Gait – ambulates with bilateral ankle-foot orthoses. Has steppage gait with mild genu recurvatum. Palpable contraction tibialis anterior bilaterally, resisted plantarflexion, able to provide resistance to inversion with palpable eversion contraction.

Noted lead neuropathy was severe with bilateral foot drop but she continues to improve with increased strength.

Bilateral hip pain, chronic etiology unknown.

Notes evaluation of bilateral hip pain with autoimmune assessment in the future.

### 4/9/2019 Dr. Shriner office visit note:

Gunshot victim and due to impaired detoxification pathways, she suffered severe distal motor and sensory polyneuropathy with bilateral foot drop at a lead level of 10. Her current lead level is 2 and for the last 8 weeks she has had motor recovery and increased sensation.

Notes Ms. Harris sees a chiropractor once a month who she saw prior to her bilateral foot drop.

*Exam:* Motor examination left foot dorsi flexion 4-/5, plantarflexion 4/5 inversion and eversion 4+/5 supine evaluation. Right foot dorsi flexion 1/5 plantarflexion 4-/5, inversion 3/5, eversion 1/5 in a supine position. She is unable to stand on her toes or heels at this time.

Sensation: decreased at both ankles and more so on the right. She also has dysesthetic sensation over the proximal medial leg where entrance and exit wounds were.

She has bilateral hip drops and genu recurvatum and bilateral foot drops without her AFOs. With her braces she has appropriate clearance. Balance remains impaired statically even with bipedal stance and it is improving.

*Plan:* Continue chelation therapy.

### 5/8/2019 Dr. Shriner office visit note:

Follow-up for chelation therapy. Continued improvement in lower extremity strength. Resumed kickboxing class. She stated she can tap her feet now, with increased toe motion right greater than left. She is walking barefoot at home for intrinsic foot strengthening and even did her kick boxing class barefoot.

Note mentions an incidental finding of cervical syringomyelia which has not been decompressed but clinically asymptomatic.

*Exam:* Motor: right dorsiflexion 2-/5 with some inversion, plantarflexion 4-/5, inversion 4-/5, eversion 3/5. Left motor shows one half to one whole motor strength improvement in all muscles tested. She has positive toe motion in the first and second toe on the right and can activate her flexor digitorum communis, digit movement; trace motor in the left first toe but 0 toe extension on the left. Able to tap her toes in a seated position but still unable to rise on her toes with plantarflexion and cannot adequately clear the floor with dorsiflexion and standing on heels bilaterally. Upper extremity musculoskeletal neurological examination is normal.

*Assessment/Plan:* She continues to improve with each follow-up. She has multiple genetic defects in all detoxification pathways.

### 6/20/2019 Dr. Shriner office visit note:

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Follow-up for bilateral foot drop due to lead toxicity from a gunshot wound. She reports feeling better with greater quadriceps strength, normal sensation on the left and improved motor function bilaterally. She has less inversion with active dorsiflexion on the right foot and ankle and indicates that it is not as difficult to dorsiflex her left ankle. She has not fallen since her last visit. Continues to do martial arts classes once weekly. She reports improved balance and is able to hold a warrior one yoga position. She can now move her toes of both feet and has been trying to pick up objects off the floor with her toes. Complaints of left-sided low back and gluteal discomfort which she relates to her need to circumduct that extremity while ambulating.

*Labs:* lead level 3; 24-hour urine lead not detected, persistent elevation of selenium

*Motor:* abduction 4+/5 and abduction 5/5, quadriceps 5/5 bilaterally, left dorsiflexion 2+/5, left inversion eversion 3-/5, 3/5 toe flexion, trace toe extension. Right dorsiflexion 1/5, right inversion and eversion 2-/5, unable to go full range of motion but with some resistance.

*Gait:* bilateral ankle foot orthoses. Circumducts less on the left side. She is unable to stand on heels or rise on toes.

*Sensation:* improved with new tactile sensation and tingling bilaterally

*Assessment/Plan:* She continues to make improvements from a motor and sensory perspective left distal extremity better than right. Improved limb girdle strength with improvement in gait. Her lead level remains 3 with negative urinary lead. Concerns for being able to bind and extract remaining lead however she stopped her flaxseed and lowered fiber intake. Continues home exercises independently. No evidence of myelopathy or signs of normal pressure hydrocephalus and syringomyelia on evaluation. Continue Chelation therapy. Ultrasound evaluation for intra-articular lead in the affected extremity.

### 7/10/2019 Dr. Shriner office visit note:

Motor exam unchanged from last visit. Inversion is much more prominent with the ability to provide some resistance bilaterally.

Lead level now back down to 2.

There was no evidence of large intra-articular pieces or soft tissue shrapnel noted on ultrasound evaluation in the affected gunshot regions. It is stated that Dr. Shriner feels they have extracted as much as they could from the soft tissues and there were no large pieces to be extracted from the bone or joints and with time the lead will slowly dissipate into the soft tissues from the bone. At those times recommendation will be for short higher dose chelation intermittently to extract soft tissues lead. She will continue to be monitored closely by serum and urine as to correlate the extract timing of the intermittent high doses of chelation.

### 8/6/2019 Dr. Shriner office visit note:

She has been off chelation therapy for 1 month. Bioness representative at clinic visit with 2 devices to assist her gait.

*Motor:* abduction 4+/5 and abduction 5/5, quadriceps 5/5 bilaterally, left dorsiflexion 4-/5, left inversion eversion 4/5, 3/5 toe flexion, trace toe extension. Right dorsiflexion 3-/5, right inversion and eversion 4-/5 unable to go full range of motion actively on right, but only minus 3 degrees to neutral actively against gravity. Toe extension 0/5 and toe flexion 3/5 on right.

*Gait:* bilateral ankle foot orthoses with bilateral trendelenburg. Her gluteus medius strength has improved with more stable pelvic motion upon ambulation. She is unable to rise on toes but with more noticeable plantar flexion. She is able to stand on heels with less hip flexion modifications.

*Sensation:* improved with new tactile sensation and tingling bilaterally

*Assessment/Plan:* She continues to make improvements from a motor and sensory perspective left distal extremity better than right. Improved limb girdle strength with improvement in gait. Her lead level is 2 with negative 24-hour urinary lead. Concerns for being able to bind and extract remaining lead. Will not

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continue to chelate as have exhausted removal from soft tissue with continued small improvements monthly in motor patterns. Her gait pattern is improved with bilateral Bioness devices. She was ambulated extensively without braces, with her ankle-foot orthoses, with bilateral Bioness and unilateral E stem. The final conclusion is with training her gait is improved with bilateral Bioness devices. Do not recommend unilateral as this throws her balance off significantly.

10/25/2019 Dr. Shriner office visit note:

Labs on July 31, 2019 show spot urinary lead 1, 24-hour urinary lead 0 and serum lead level of 2. Serum lead level October 2019, is 3 with 0 content in the urine. Last time she had a lead level of 3 was the beginning of July right before she completed the Succimer. Since that time, she has had 2 repeat values with a serum lead level of 2. She has been off chelation therapy since mid-July. She has obtained funding through donor support for her Bioness. Insurance has denied payment.

She is complaining of paresthesias along the right lateral thorax which feels like a tingling sensation. She reports this has been there before but not articulating it other than complaining of a muscle strain. There are no bowel or bladder difficulties. She does report slight improvement in gait. She is complaining of short-term memory loss and impairment in organizational skills. She indicates that she has forgotten two appointments. However, she denies feeling depressed when questioned by her mother. She is seeing a psychologist. There have been no falls. She continues to wear her bilateral ankle-foot orthoses and do her home exercise program.

*Exam Motor:* Abduction 4+/5 and adduction 5/5, quadriceps 4+/5 bilaterally; left - dorsiflexion 4+/5, left - inversion 4/5 eversion 4-/5, 3/5 toe flexion, trace toe extension. Right - dorsi flexion 3/5, right - inversion 4-/5 and eversion 4-/5 unable to go full range of motion actively on right, but only minus 3 degrees to neutral actively against gravity. Toe extension 0/5 and toe flexion 3/5 on the right

*Gait:* She ambulates with bilateral ankle-foot orthoses with improved bilateral trendelenburg. There is also decreased circumduction. Her gluteus medius strength has improved with more stable pelvic motion upon ambulation. Her motor strength has improved slowly with each visit but she is still unable to safely ambulate without assisted dorsiflexion.

*Sensation:* Improved with new tactile sensation and tingling bilaterally. Unchanged from prior exam in LEs. However more tingling sensation noted on the right from C5 through most of her thoracic spine. Clearly negative at C4 bilaterally. There is no delineating neurological level.

*Assessment/Plan:* She continues to make improvements from a motor and sensory perspective left distal extremity better than the right. Improved limb girdle strength with improvement in gait. Treatment not rendered with slight elevation as she continues to slowly improve clinically. Although improved, she has significant motor dysfunction and would greatly benefit from continual stimulation by Bioness devices.

"Today is the first time she reports cognitive impairments involving short-term memory and organizational skills. Recommendations would be for complete neurocognitive testing to objectively document her symptoms. Also she reports for the first time, dysesthetic sensation in the right lateral thorax. She does not appear to have a neurological level and there are no signs of upper motor neuron dysfunction. She does have pelvic obliquity with more than 1 rotational component. Her right lateral thoracic discomfort is most likely secondary to biomechanical changes from persistently abnormal gait pattern. Unclear as to why she has impaired sensation in this region based on her clinical exam today."

11/1/2019 Dr. Shriner office visit note:

Left LE pain and instability

Morgan was asked to follow-up today for treatment of her pelvic obliquity and close reassessment of her neurological status due to reports of tingling in the right lateral thorax.

She is doing well at work and was recently evaluated in the top 5% and they are making all modifications needed for her employment. Currently she does all job tasks without restrictions.

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*Exam:*

*Motor:* Abduction 4+/5 and adduction 5/5, quadriceps 4+/5 bilaterally; left - dorsiflexion 4+/5, left - inversion 4/5 eversion 4-/5, 3/5 toe flexion, trace toe extension. Right - dorsi flexion 3/5, right - inversion 4-/5 and eversion 4-/5 unable to go full range of motion actively on right, but only minus 3 degrees to neutral actively against gravity. Toe extension 0/5 and toe flexion 3/5 on the right

*Gait:* She ambulates with bilateral ankle-foot orthoses with improved bilateral Trendelenburg. There is also decreased circumduction. Her gluteus medius strength has improved with more stable pelvic motion upon ambulation. Her motor strength has improved slowly with each visit but she is still unable to safely ambulate without assisted dorsiflexion. *Sensation:* Improved with new tactile sensation and tingling bilaterally. Unchanged from prior exam in LEs.

*Sensory assessment* today shows decreased sensation on the right side starting at T11. There is clearly no involvement in a cape-like distribution; C4-C5. No proximal sensory changes and no upper motor neuron findings.

*Assessment/Plan:* Neurocognitive testing to be ordered at a later date due to time restraints and the need for her e-stim devices as neurocognitive testing is extremely expensive.

The dysesthetic sensation in the right lateral thorax is not showing consistent level with 2 neurological evaluations separated in time. She also does not appear to have any upper motor neuron dysfunction. It was felt the right lateral thorax tingling and achiness was related to secondary biomechanical changes in her abnormal gait and pelvic obliquity which is also secondary to the distal extremity impairment. Her pelvic obliquity was corrected today and her mother was shown how to do paraspinal stretching.

Neurosurgical Associates office notes

8/29/2018 Office note from Dr. Arnold B Vardiman, MD:

CT brain – profound ventriculomegaly with evidence of hydrosyringomyelia extending into the upper cervical canal.

CT cervical spine – demonstrating profound hydrosyringomyelia with apparent associated Chiari malformation.

*Exam:* Bilateral foot drop. Sensory exam consistent with peripheral sensory neuropathy. Reflexes are trace and symmetric. Ambulates with a hesitant gait.

*Assessment and Plan:* “I am very concerned that Morgan, in fact, has a symptomatic Chiari malformation and associated hydrosyringomyelia.” He then referred her for a second opinion from Dr. Christopher Bogaev.

9/4/2018 Office note from Dr. Christopher Bogaev, MD:

CT brain and spine imaging showed a large cervicothoracic syrinx with syringobilia. She also has diffuse hydrocephalus involving the entire ventricular system.

Not able to have an MRI scan because of bullet fragments remaining in her body.

*Exam:* 4/5 strength in lower extremities except for 3/5 dorsiflexion and plantar flexion in the right lower extremity. Sensation of light touch diminished throughout the bilateral lower extremities. Reflexes are hyperactive in the lower extremities. She is unable to ambulate without a cane.

*Assessment and Plan:* Worsening neurologic dysfunction from diffuse hydrocephalus as well as syringomyelia. He did not feel a direct intervention on the syrinx would be in her best interest. She appears to have a Chiari malformation secondary to her severe hydrocephalus. He felt the best initial step was for a ventriculoperitoneal shunt placement. After the shunt is placed the syrinx can be monitored. If it fails to resolve with resolution of her hydrocephalus, then Chiari surgery can be considered as a second stage.

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Chief complaint of progressive development of foot drop, first on left and then right.

"A hydrocephalus was also found. She saw Dr. Vardiman and Dr. Bogaev who discussed VP shunt; however ultimate etiology of her foot drop was determined to be lead poisoning but initial blood level was not high. The large ventricles were felt to be congenital and the final discussion was that no shunt was needed." Genetic study identified metabolic filtering abnormality.

ROS: complaining of memory lapses or loss, fatigue, numbness, unsteady gait, lower back pain, anxiety. Denies hand involvement with respect to control or weakness.

Has right AFO and bilateral Bioness ankle units. Used crutches, walker, and cane in the past. Used a shower chair for 6 months in the past but can now stand in her tub/shower combination without accommodations.

*Exam:* Upper extremities 5/5. Left lower extremity hip flexors 5/5, quadriceps 5/5, hamstring 5/5, tibialis anterior 4/5. Gastrocnemius 4+/5, extensor hallucis longus 4-/5, extensor digitorum brevis 4/5.

Right lower extremity hip flexors 5/5, quadriceps 5/5, hamstring 5/5, tibialis anterior 4/5. Gastrocnemius 4+/5, extensor hallucis longus 3+/5, extensor digitorum brevis 3+/5. On deep tendon reflexes, sensation is decreased on the right below the knee compared to the left. Sensation is decreased on the left from the foot to the thigh.

EMG/NCS: Nerve conduction velocity studies were normal but negative F waves bilaterally. There is motor axonal involvement yielding bilateral distal lower extremity weakness.

Had oral chelation for 6-8 months.

She is still driving without accommodations.

Spends \$180-200 per month on nutritional supplements.

Ms. Harris had physical therapy for 6 months in the past, and then for the past 4 months she had therapy 2x per week. She claims some decreased sensation on the right up to the trunk.

*Impression/plan:* Bilateral foot drop, left worse than right secondary to heavy metal toxicity. Continue AFOs and Bioness Units. Given 2 years from onset, likely a permanent impairment.

### 3/30/2020 Dr. L. Douglas Wilkerson:

Ms. Harris was examined on 3/11/2020.

She has been wearing AFOs for about 6 months which were discontinued in favor of a device to facilitate foot dorsiflexion. At the time of the examination, she described herself as partly ambulatory without braces although limited in ability by fatigue. She reported she used her "whole foot" to operate the brake and gas pedal while driving.

"Regarding cognitive deficits, she did not report any initial symptoms but rather they developed around 12-18 months ago [*although it was first noted in 10/2019 per Dr. Shriner's notes*]. There was not a clear delineation but rather an increasing awareness of struggles with multiple tasks, stating she has become forgetful." She spoke of difficulty retrieving phrases or specific words. Endorsed difficulty remembering directions, appointments. She said this was leading to increased frustration at work with needing to revise or rewrite her work. She said she was having difficulty remembering what she read and needed to read the same thing multiple times. She said she had difficulty with multi-tasking across various conversations and was also having problems managing her bills.

She education involved being home schooled with no history of any standardized testing. She taught herself her IT skills.

She stated her prior Chiari malformation was asymptomatic.

*Exam:* Showed some cognitive deficits with written computations, summing a total, extracting inference in reading of a passage. On physical examination mild distal muscle wasting in bilateral lower extremities. Repeated toe tapping was "slow and awkward." Mild-to-moderate steppage gait, limited ability to walk on her forefeet and unable to walk on heels or perform tandem gait. Sensory showed mild stocking glove distribution to pinprick and cold in all extremities (pain and temp), worse on right

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foot laterally. Motor intact except for 4/5 distal weakness in lower extremities especially involving extensors of the great toe and distal foot more than inverters of feet and flexors of the ankle. Reflexes intact in upper extremities but trace at the brachioradialis. Achilles reflexes absent.

The report states she has suffered both a peripheral neuropathy and mild chronic encephalopathy (affecting calculation, memory, auditory and visual processing and organization requiring attention to detail) attributable to lead poisoning from retained shrapnel from her gunshot wound. Dr. Wilkerson stated that she also is advised against having children. He is also stating that her cognitive impairment restricts her ability for successful employment at a level commensurate with her education and that she will need ongoing support to manage finances.

5/6/2020 through 8/2020 Office notes of J. Patrick Lincoln, Jr. LCSW for psychotherapy and counseling:  
She had 9 sessions and was recommended more.

Initial assessment commented on Ms. Harris's report of increasing levels of anxiety and emotionality. She endorsed that her previous cognitive functioning was declining and she would forget words and memories more frequently, "she can also feel overwhelmed and has some difficulty with concentration and memory recall." It is noted that she is concerned that there may be a neurological cause to her perceived mental decline, possibly due to lead toxicity. It was recommended she had neuropsychological testing to clarify present neuro-cognitive functioning levels.

"Presently she meets the diagnostic criteria of an adjustment disorder with anxiety and depression, moderate to severe." The note states she believes the counseling has been helping her.

Of note, on 6/19/2020 it is noted that "work/employment going well, complimented on work ethics, performance."

On 8/31/2020, he recommended a referral to a psychiatrist for possible psychotropic medication to help with "sadness, depression, and anxiety."

### 8/2020 Neuropsychological evaluation report by Sean Connolly, PhD:

Currently employed as an operations assistant for 2 years. She noted that she "does well on the job." She stated she has noticed some issues in the last six months, but "her employer is satisfied with her performance."

*Summary and discussion:* "She is showing signs of onset of mild neurocognitive struggles: Auditory memory [*This was still in the average range*], eye-hand coordination, and set shifting are the most prominent areas of deficiency reflected in her test data. Otherwise, as this time, she presents as doing reasonably well in many cognitive areas. The assessment data would indicate reasonably good neurocognitive functions, other than such areas as eye-hand coordination, set shifting related to multi-tasking, and memory functioning. Continued psychotherapy is recommended, and also engage in Cognitive Retraining activities...." [*Of note, I do not see validity scales to gage effort of performance*].

### Magenta Health Records:

- Marc Gardner, PT. First visit with this therapist was 8/8/2019 for 4 months, approximately 2x per week. Prior to this she had had PT for 6 months. Notes state Peroneal Nerve palsy: "Patient presents with signs and symptoms consistent with bilateral peroneal nerve myelopathy due to toxic lead levels. **Chiari malformation may also be a partial cause of neurologic compromise.**" [*Peroneal palsy not supported by EMG findings*].

- Selena Gray, D. C., 6/2018 (Chiropractor initial visit): states history of severe neck pain, headaches with onset of headaches that got progressively worse over 2 years. Notes unable to ride roller coaster for past 5 years due to neck/headaches: "Prior to GSW in November 2017, she notes that over the past 5

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years she has had neck complaints and abrupt onset of severe headaches. She also notes back pain that generally resolved quickly with manipulations.

- Dr. Michelle Carroll Bost Rodriguez (PCP): H/o compressed nerve in neck few years ago and would get numbness on right side of body, mostly in right lateral leg and left shin to the point she couldn't feel razor when shaving. Always been a light sleeper but worse with pain (takes Tylenol when needed).

### 8/25/2018 and 12/15/2019 visits with Dr. Ticknor (Psychiatrist)

Stated Ms. Harris had a diagnosis of an adjustment disorder and depressed mood.

*"I have a high lead level in my body. And a genetic condition that makes it hard for me to detoxify things like lead. I have a lot of inflammation in my body and especially in my legs. I was on a chelation therapy February through July of 2019, but it hasn't helped as much as we hoped. My lead levels are still too high. It went down somewhat, but not enough that I can safely have a child."*

*"I know I'm not the same person I was. I have a lot of mood swings, trouble controlling them, and too many down days. I'm very easily fatigued. It affects my activities and concentration. I thought it was just me, but now I think it's at least partially the lead in my body. It's making me depressed most of the time."*

Dr. Ticknor's report stated that Morgan Workman suffers from moderate to severe adjustment disorder with depressed mood symptoms. Morgan Workman specifically requires intensive cognitive behavioral therapy, likely over the course of many years, to help her adjust to the psychological and physical scars that affect her on a daily basis.

### **Summary of testing:**

Lead blood test:

Environmental exposure:

WHO recommendation < 20

Occupational Exposure:

OSHA Lead Std 40

BEI 30

Test developed by LabCorp and not approved by FDA

### **Labs:**

6/21/2018

Lead, blood 8 µg/dL (0-19) NOT ELEVATED according to reference range.

Selenium 177 (91-198)

Thyroid normal, chemistry normal, CD57-78, WBC unrevealing, ANA comprehensive negative, IgA low, IgG subclass negative, heavy metals/lead - 8, arsenic 5, ACE negative, Vitamin D 31, Lyme negative, MTHFR - single mutation 677T, homocysteine 7.3, sed rate 4, thyroglobulin antibody negative, copper 120, zinc 86, magnesium 5

10/09/2018

LP results 10/09/18: CSF VDRL non-reactive, cytology negative, less than 1 WBC, glucose 50, total protein 28. (Requested by insurance company before IVIG could be approved).

MS Panel: Bands 0, Myelin Basic Protein elevated at 2.3 (for research purposes only).

10/16/2018

Lead, blood 7 µg/dL (0-4) HIGH

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TFI's unrevealing, LD Is-a-enzymes are unremarkable, IgG and IgG subclass were only partially performed. Her HTLB1 antibodies were negative, Aldolase negative, B12 451, heavy metals, lead was 7, normal was less than 4, arsenic 11, Cadmium negative, hemoglobin A1C is 5.2, methylmalonic acid 164.

10/17/2018 Quick Silver sample arrived, 11/2/2018 reported: Lead is at the 99.9 percentile, also Strontium is at about the 60th percentile, others Cadmium and Cobalt were below the 50th percentile. Quicksilver Scientific is a nutraceutical company and commercial laboratory. Only supply heavy metals results.

10/29/2018

Lead, blood 6 µg/dL (0-4) HIGH

3/5/2019

Lead, blood 3 µg/dL (0-4)

Selenium 177 (91-198)

6/6/2019

Lead, blood 3 µg/dL (0-4)

Lead, urine 0 detected (0-49)

Selenium 224 µg/L (91-198)

7/5/2019

Lead urine 2 µg/L (0-49)

Lead, blood 2 µg/dL (0-4)

7/29/2019

Lead urine 1 µg/L (0-49)

Lead, blood 2 µg/dL (0-4)

10/17/2019

Lead urine None detected (0-49)

Lead, blood 3 µg/dL (0-4)

Selenium 193 µg/L (91-198)

### IMAGING:

A CT of her neck and back were done at UH in December 2017. [I do not have a copy of this report].

7/03/2018 CT head with and without contrast:

**(I personally reviewed these images and agree with the interpretation)**

There is profound dilatation of the lateral, third, and fourth ventricles. Marked hydrocephalus and large upper cervical cord syrinx detected (suspicious for CSF block). MRI with CSF flow through the foramen magnum would be useful in evaluating for obstruction.

7/24/2018 CT Cervical spine without contrast:

**(I personally reviewed these images and agree with the interpretation)**

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Cervical Syrinx. The cervical vertebrae are normal in appearance. The spinal cord is not well visualized, but there does appear to be a prominent syrinx in the upper cervical cord, with impaction of the cerebellar tonsils in the foramen magnum, stable from 7/3/2018.

### 10/9/2018 Fluoroscopically-guided spinal tap:

Opening pressure is **elevated at 33 cmH<sub>2</sub>O**. 15 cc of clear CSF fluid were removed. Closing pressure was 12 cmH<sub>2</sub>O.

### ELECTROPHYSIOLOGY TESTING:

#### 7/10/2018 Visual Evoked Potential report (By Suzanne Gazada, MD)

Reports primary complaints of possible MS. Patient suffers with vision problems, loss of balance, foot drop, weakness to the legs, numbness, tingling, swelling, back pain, legs feel tired and heavy, trips and falls and drags feet when walking – complaints for past 6 months.

Impression: Normal VEP with unremarkable findings.

#### 7/10/2018 NCV/EMG (By Richard B. Neiman, MD)

Complaints of bilateral weakness and numbness to the feet. Suffers with foot drop, weakness, numbness, tingling, swelling, back pain, legs feel tired and heavy, and she trips and falls and drags feet when walking. Symptoms for past 6 months.

Impression: There is electrodiagnostic evidence of prolonged unresponsive F-wave and H-waves bilaterally. The peripheral neuropathic wave forms look intact. Differential diagnosis could be an early demyelinating neuropathy, more proximal nerve root lesion, or central process. Clinical correlation is recommended.

Per Dr. Gazda's notes: Thus, showing absent F-waves in both lower extremities, otherwise normal NCV's. EMG consistent with distal neuropathy.

#### 1/8/2019 Repeat NCV/EMG (By Richard B. Neiman, MD)

Impression: There is electrodiagnostic evidence of more progressive neuropathic features. She had previously had F-wave and H-wave abnormalities that are still present, however it appears there are continued progressive motor abnormalities.

### 10/9/2018 Unilateral right lower extremity venous doppler ultrasound

The deep venous systems of the right lower extremity were evaluated from the level of the groin to the level of the trifurcation. No evidence of deep venous thrombosis (DVT). The veins are normally compressible, and exhibit spontaneous and augmentable flow.

### 12/11/2018 DetoxiGenomic Profile

Not approved by FDA and accuracy is not 100%

Profile identifies genetic variations that may affect ability to detoxify specific toxins.

Polymorphisms detected in CYP1B1 and CYP2C19, increasing susceptibilities to toxins.

Genetic variations also found in COMT, NAT2, SOD2

### Deposition of Morgan Harris 5/21/2020:

She was homeschooled and does not have a GED or equivalent formal education diploma. When she graduated the documentation provided was by her parents. She has not attended college. She is currently an operations assistant at Mailgun Technologies. She helps with day-to-day functions of the business. Worked there for 1.5 years, started 8/2018, when her internship ended, she was hired on as a part-time employee, at \$16 per hour. Prior to this she worked at a chiropractic office as a receptionist

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for 6-8 months, 1/2018 – 7/2018, at \$11 per hour. Prior to this she was a martial arts instructor. She was an assistant instructor since 2012, and a head instructor from 2015 – 11/2017, at \$12 an hour. She did not continue to work as an instructor after 11/2017. She stated she is currently satisfied with her current job and does not have aspirations or goals for a next job.

Saw Dr. Shriner 12/2018 – 3/2020 when her office closed due to the pandemic. She said Dr. Shriner intermittently has had her on a chelator.

Ms. Harris stated she was not currently on a chelator. She said she stopped 7/2019 because it was no longer as effective, it wasn't lowering the lead level in the blood past below 2. She said it was a strong medication. She said her level had been stable at a 2-4 the last few times it was checked.

She said a level 2 in her blood had caused her to have bilateral drop foot and cognitive issues.

She stated she was taking 6 different supplements to help process the toxins out of her body. She said she was doing in-home physical therapy. She does the exercises by herself with different recommendations that different doctors gave her to specifically help.

She said her physical condition was at its worst in ~ 6/2018. She experienced a neuropathy causing a bilateral foot drop but it had not been diagnosed yet. After she was diagnosed, she started physical therapy, in the fall of 2018. She states the physical therapy has not helped the severity, only the surrounding muscles. She says the condition is mildly better today. She said after the chelator she had a little more functionality and a small amount of more feeling in her feet and through her legs. She said the nerve pain and symptoms have stayed the same. She also stated that because of the way she walks, she experiences a lot of lower back and mid-back pain and a lot of pain in her hips. She currently wears a unit called a Bioness L300, its an electric stimulant device that sends an electronic pulse into the muscles to lift the foot because of the foot drop. When she does not wear the stimulation device she uses AFOs/static braces that go into her shoe and hold her foot at a 90 degree angle. When she uses the Bioness to walk she does not require a cane. She states she is able to drive modified – since she cannot extend her foot to accelerate, she has to place the bottom of her foot towards the heel on the accelerator or the brake and has to use her entire leg to apply pressure. She drives herself to work.

She said she has cognitive issues, including poor memory and staying on task. She states she has lost the ability to multitask and gets overwhelmed now when multiple people are trying to talk at her at the same time. She states she has not very clear thoughts. She states she loses words or cannot recall them. She said these cognitive issues have been tied to her lead toxicity. She states she is currently not seeking therapies to address these specific cognition issues and are unsure if there are any that could be offered. Ms. Harris states she has a lot of worry because the whole situation creates a lot of stress. She states she has minor anxieties before the shooting but now has a lot of anxieties that she is not able to deal with now like she had in the past. She said know she has depression, mood swings, and a lot of anxiety and fear. She states her anxieties and fears have been at a steady level since the time of the shooting. She endorses that she saw a counselor and currently is seeing Dr. Pat Lincoln weekly. She stated she and her therapist focus on talk therapy and a few meditation techniques to try and use. She stated she does have sleep issues due to pain, described as keeping her up with an intense burning sensation or cramps. It prevents her from falling asleep and wakes her up at night.

She denies nightmares or flashbacks. However, when asked if she thinks about the shooting, she said she thinks about on a daily basis and then endorsed that her heart races, she gets sweaty and starts shaking on occasion, about once a week. She said Dr. Ticknor diagnosed her with PTSD.

She was told she was unable to have children because the toxicity in her body will have an effect on the embryo in the third trimester and that the lead would leak out and affect the child.

### Opinion

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Ms. Morgan Harris was involved in the mass shooting at the First Baptist Church in Sutherland Springs, Texas, on 11/5/2017. She was shot twice in the left leg. A CT on 11/5/2017 showed no evidence of intraarticular shrapnel with an intact vascular system with no neurovascular injury on assessment. She also suffered shrapnel injuries to the right upper extremity, the right anterior chest wall and face. It was determined not to debride or attempt direct shrapnel removal owing to the multiplicity of small fragments spread in surrounding tissues. She was discharged home ambulating on crutches for three weeks and then moved to a single point cane for 2 weeks. She returned to work in January 2018. She endorsed low back pain and feeling weak but she did have a history of neck and back pain for which she had seen a chiropractor in the past. She denied motor or sensory disturbance in either lower extremity during the initial 8-10 weeks following the injury. However, by February 2018, she began tripping and falling with a worsening gait pattern. In May 2018, she saw Dr. Gazada who completed a neurologic work up for bilateral foot drop. Dr. Gazada eventually found heavy metal toxicity (lead blood level was normal on 6/2018 testing but abnormal on 10/2018 testing). For management of the foot drop, AFOs were prescribed in June 2018 which she continues to wear as well as bilateral Bioness devices, which were shown to improve her gait pattern. During Ms. Harris's work up, an Arnold Chiari Malformation Type I with profound hydrocephalus involving the entire ventricular system was also found on neuroimaging. Per the medical records, she endorsed symptoms of neck and low back pain for approximately one and half years prior to the shooting that are likely attributed to the Arnold Chiari Malformation and profound hydrocephalus. The pain had been managed with conservative care primarily with a chiropractor prior to the shooting. After the shooting, she was evaluated by two neurosurgeons who both recommended placement of a VP shunt and questioned long standing symptoms. Ms. Harris declined this procedure. Nevertheless, Ms. Harris continued to have bilateral foot drop, at its worst, per the patient, in 6/2018 prior to an elevated lead blood level. Ms. Harris had multiple lab tests throughout her workup. Her first lead blood level on 6/21/2018 was 8 µg/dL (0-19), which was not elevated according to reference range of the test (LabCorp), and reportedly when she said her physical condition was at its worst. On 10/16/2018, her blood was rechecked and showed an elevated lead blood level of 7 µg/dL (0-4), which also corresponds to when her labs were sent to QuickSilver. She was also found to have genetic defects in several metabolism pathways which "may affect ability to detoxify specific toxins." She then began Chelation therapy for lead toxicity in February 2019 through July 2019. Her blood lead levels were reduced to 2-3 µg/dL and her urine lead was zero, below the reported lead toxicity range. In 10/2019, 2 years after the shooting and after stable improvement in her blood lead levels to normal range, she started to complain of cognitive issues. She related these cognitive changes to increased lead blood levels. However, at that time the cognitive complaints started, she had stable blood lead levels between 2-3 µg/dL for several months, suggesting possible other related causes for her subjective cognitive complaints.

In 1999, the Centers for Disease Control (CDC) and Prevention's Adult Blood Lead Epidemiology and Surveillance program defined an elevated blood lead level (BLL) in an adult as 25 µg/dl or greater, and the Occupational Safety and Health Administration's (OSHA) level for medical removal from the workplace was 50 µg/dl or greater. According to a comprehensive review put forth in 2007 by an expert panel evaluating literature on lead-exposure in adults, the panel recommended that individuals be "removed from lead exposure if a single blood lead concentration exceeded 30 µg/dL or if two successive blood lead concentrations measured over a 4-week interval were ≥ 20 µg/dL. Removal of individuals from lead exposure was recommended to avoid long-term risk to health if exposure control measures over an extended period did not decrease blood lead concentrations to < 10 µg/dL...with semiannual blood lead measurements when sustained blood lead concentrations are < 10 µg/dL" (Kosnett et al. 2007). Regarding blood lead levels in pregnancy, the CDC recommends a precautionary

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approach, noting that a BLL  $\geq 5 \mu\text{g/dL}$  in a pregnant woman indicates that she has or has had exposure to lead above that for most women of child bearing age in the United States. For occupationally exposed pregnant women, the recommendation is to keep BLLs as low as possible and to remove pregnant women from lead-exposed work areas if BLLs are  $\geq 10 \mu\text{g/dL}$ . It is advisable for pregnant women to avoid occupational or avocational lead exposure that would result in blood lead concentrations  $> 5 \mu\text{g/dL}$ . Of note, Ms. Harris has continued to maintain a blood lead level  $< 5 \mu\text{g/dL}$  after chelation and a urine level of zero.

According to the Potential Health Risks to DOD Firing-Range Personnel from Recurrent Lead Exposure, put forth by multiple committees, "effects of occupational lead exposure on the peripheral nervous system at BLLs of 60-70  $\mu\text{g/dL}$  are manifested as motor weakness with abnormalities in motor and sensory nerve conduction. No peripheral motor or sensory symptoms are known to occur at BLLs under 40  $\mu\text{g/dL}$ ." Changes in sensory nerve function occurred at BLLs of 28-30  $\mu\text{g/dL}$  (Chuang et al. 2000; Bleeker et al. 2005). Visual evoked potentials, measuring speed of conduction in the optic nerves, were prolonged beginning at BLLs of 17-20  $\mu\text{g/dL}$  (Abbate et al. 1995). A calculated benchmark dose for postural sway (measure of balance) was at a BLL of 14  $\mu\text{g/dL}$  (Iwata et al. 2005)." In addition, in a paper by Thomas & Parry 2006, "Lead is toxic to multiple organ systems and isolated lead neuropathy is very uncommon. In children the major manifestation of lead exposure is encephalopathy. The adult brain seems relatively resistant to its effects, except in cases of massive acute exposure. Lead neuropathy usually occurs as the result of high levels of exposure, and at such levels other effects are almost invariably observed, including bone marrow suppression (anemia and leukopenia), gastrointestinal tract effects (GI hemorrhage, diarrhea), renal effects (proteinuria, renal failure), hypertension, and gout." Ms. Harris did not exhibit these other physiological signs and symptoms typically seen in association with elevated lead toxicity, again questioning the true relation of her symptoms to her mildly elevated blood lead levels.

In the paper by Krieg et al. 2005, aimed at assessing the relationship between blood lead levels and neurobehavioral test performance in a nationally representative sample of adults from the third National Health and Nutrition Evaluation Survey data (NHANES III), the authors showed that the results from the survey did not provide evidence for impairment of neurobehavioral test performance in adults at levels below 25  $\mu\text{g/dl}$ , or at lead concentrations currently found in the general adult population of the United States. The analysis of the occupational studies showed that the exposed groups consistently performed worse on the simple reaction time and digit-symbol substitution tests. The average blood lead level of the control groups was 11.42  $\mu\text{g/dl}$ . The average blood lead level of the exposed groups was 41.07  $\mu\text{g/dl}$ , greater than 25  $\mu\text{g/dl}$  and less than 50  $\mu\text{g/dl}$ . From the Environmental Protection Agency 2006 Air Quality Criteria Document: "Evidence in support of EPA's conclusion included onset of diminished cognitive function and diminished psychomotor speed at a BLL of 18  $\mu\text{g/dL}$  (Schwarz et al. 2001). Zimmermann-Tansella et al. 1983, "show that in occupationally exposed workers, blood lead levels ranging from 45 to 60  $\mu\text{g}/100 \text{ ml}$  induced significant performance deficits, while no impairment was observed in exposed workers with lead blood levels between 26 and 35  $\mu\text{g}/100 \text{ ml}$  when compared with a non-exposed control group. Lead exposure levels below 70  $\mu\text{g}/100 \text{ ml}$  were stated to be unrelated to the number and frequency of psychological symptoms as well as to most specific psychological complaints. Some specific symptoms such as concentration difficulties and forgetfulness appear sensitive to lead exposure but only above 50  $\mu\text{g}/100 \text{ ml}$ ."

Prior to the shooting, Ms. Harris had a history of chronic hip pain and bilateral genu recurvatum (a deformity in the knee joint/knee hyperextension, more common in women and people with familial ligamentous laxity). This suggests that Ms. Harris had hip pain and joint issues prior to shooting. She also

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has a congenital Chiari I malformation with marked hydrocephalus. Per neurosurgery assessment, she had a Chiari I malformation secondary to her severe hydrocephalus, confirmed with high opening pressure on lumbar puncture and neuroimaging with a CT of her brain and spine showing a large cervicothoracic syrinx with diffuse hydrocephalus involving the entire ventricular system. Neurosurgical assessment stated Ms. Harris had worsening neurological dysfunction from diffuse hydrocephalus as well as syringomyelia. Two neurosurgeons felt the best initial step was for a ventriculoperitoneal shunt placement which Ms. Harris did not pursue. In multiple notes and reports, it was suggested that Ms. Harris had been asymptomatic from her Chiari I malformation however, she did have a 5-year history of neck complaints and abrupt onset of severe headaches, a 1.5-year history of lower back pain, hip pain that disrupted her sleep, and previous right sided numbness, that all pre-dated the shooting. Ms. Harris had 2 EMGs done, one on 7/2018 and a repeat evaluation done on 1/8/2019. The first EMG report was essentially normal (only F wave and H reflex abnormalities were seen which could be technical), performed at the time when her symptoms were reportedly at their worst. On the nerve conduction portion in both reports, the peroneal nerve (related to causation of foot drop) motor and sensory responses were normal. The other late or absent responses of the H and F waves are difficult to measure technically and absence could be technical, especially since in the first test Ms. Harris had an absent H reflex but ankle jerks present on a separate office visit exam which does not make physiological sense given they measure the same thing. In addition, on the second test, which reportedly showed "more progressive neuropathic features," the test was performed at 22.8-23.2 degree Celsius which is considered cold (a patient's surface temperature should be between 31 to 34 degrees Celsius, and is essential to obtaining and presenting correct nerve conduction studies) and thus can cause any slight reduction in conduction velocity seen. Lastly, in the needle portion of the studies, in the only peroneal muscle tested, there is no activity recorded in the first test (including no assessment of spontaneous activity). In the second test, the same peroneal-innervated muscle shows reduced activation without motor unit morphology changes or abnormal spontaneous activity. While in rare cases, these findings could reflect proximal demyelination, this pattern is much more commonly due to pain, poor effort, or a central process that would be consistent with Ms. Harris's known large cervicothoracic syrinx and diffuse hydrocephalus. Thus, without other abnormal responses, these studies argue against a peripheral neuropathy causing her bilateral foot drop. Of note, in Dr. Neiman's differential diagnosis proposed in his EMG assessment and interpretation, he does mention a central nervous system disorder as a possible cause of the abnormalities he found. Multiple articles in the literature also support the development of neuropathy associated with central processes such as hydrocephalus and Chiari I malformations. In Dr. Paul Yakovlev's chapter on Paraplegias of Hydrocephalics, a slow development of paraplegia "following an apparently arrested hydrocephaly" was described. "Hydrocephalic dilatation of the lateral ventricles must stretch the long paracentral fibers for the lower extremities first and most while the shorter fibers for the face and arms...may be either entirely spared or may become involved only in extreme degrees of hydrocephaly. The paraplegia is prevalently of distal distribution, toes and ankles most affected, legs less so, and hips are the least affected. The paraplegia may insidiously progress during the later course of life." Panda et al. 2013, described a case of a patient with a Chiari I malformation along with a holocord syringomyelia with progressive development of foot drop over a 2-month span in his later teen years that was initially misdiagnosed to be foot drop secondary to peripheral nerve involvement. His EMG also showed normal NCS but absent F wave and the needle EMG showed proximal muscle involvement. The patient described in this article underwent a suboccipital craniectomy and decompression of the foramen magnum with marked improvement in foot drop. In another paper by Novegno et al. 2008, 2 patients with progressive worsening of supratentorial hydrocephalus associated with new-onset cervical syringomyelia underwent an endoscopic third ventriculostomy and had drastic improvement in their symptoms. Ms. Harris's continued motor and sensory symptoms despite only mildly elevated BLLs

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with improvement in lead levels to normal range, lend support for other causes of her deficits. Thus, Ms. Harris's symptoms are likely related to her premorbid conditions and may be worsening in the setting of no intervention.

Ms. Harris first complained of some cognitive difficulty in a 10/25/2019 office visit with Dr. Shriner. In her deposition, she stated these cognitive issues had been tied to her lead toxicity however, the lead blood level had consistently remained low since 3/2019 and was 3 µg/dL at the time of her first complaint. She endorsed difficulty retrieving phrases or specific words and remembering directions and appointments. She stated she was not currently seeking therapies at that time to address these specific cognition issues and was unsure if there were any that could be offered. In her deposition, Ms. Harris stated she had a lot of worry and stress since the shooting. She stated she had depression, mood swings, and a lot of anxiety and fear, all of which can affect cognitive functioning. There is a vast medical literature that supports memory deficits associated with depression and anxiety (Hubbard, NA, et al., 2015; Shelton, D & Kirwan, CB, 2013; Hubbard, NA, et al., 2016; Gaddy MA et al., 2014). She also endorsed tossing and turning at night due to hip pain and poor sleep (a chronic issue she had endorsed prior to the shooting according to Dr. Shriner's notes: "She has discomfort in both hips that awaken her and this is a long-standing problem prior to the shooting"). Poor sleep can also result in poor concentration and word finding problems. Additionally, studies done in patients with hydrocephalus, "using standardized tests of cognitive function, have identified a general pattern of deficits, with patients exhibiting particular difficulty on tests of spatial memory (navigational behavior) and executive function...a significant number of individuals with hydrocephalus despite having normal verbal and emotional intelligence, have a significant degree of cognitive dysfunction in many areas including memory, attention, and executive functioning" (Iddon et al. 2004). Dr. Botex's paper on Occult Hydrocephalus describes some of the main features associated with this diagnosis consist of vague complaints of "depression, sleeplessness, and forgetfulness," similar to Ms. Harris's complaints. Novegno et al. 2008, demonstrated that in patients with a Chiari Type 1 malformation, "despite having a normal mean IQ, neuropsychological processing deficits in language skills were evident in 50% of the patients who underwent neuropsychological assessment. Qualitative analysis demonstrated slowed speech, lack of fluency, and word-finding difficulties," which are again consistent with Ms. Harris's complaints and performance on neuropsychological testing. Thus, her cognitive complaints are likely associated with her anxiety and depression, difficulties with sleep, and presence of long-term profound hydrocephalus.

Formal neuropsychological testing was done in 8/2020 by Dr. Conolly, who stated that Ms. Harris was "doing reasonably well in many cognitive areas. The assessment data would indicate reasonably good neurocognitive functions other than such areas as eye-hand coordination, set shifting related to multi-tasking, and memory functioning." However, her raw scores show Ms. Harris performed well on working memory which assesses concentration, including "one's ability to retain information in memory, effectiveness in retaining information one hears, ability to focus listening ability, and capacity for auditory attentiveness and concentration. It involves attention, concentration, mental control, and reasoning" (from Dr. Conolly's report) and she scored in the 70<sup>th</sup>%ile in this category. She did appear to score lower than the other categories in processing speed. In Dr. Connolly's report it mentions that in the area of processing speed, she showed good visual processing and alertness to visual detail, with moderate limitations to eye-hand coordination. However, these findings can also be related to psychomotor slowing often seen in patients with depression. She did demonstrate areas of deficits in fluency, which Dr. Conolly states "is consistent with neurocognitive difficulties." Despite her performance in working memory, it is mentioned that another one of her areas of deficits was in auditory memory but, she did perform in the average range in this category. In assessing her reasoning,

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abstraction, and cognitive flexibility, areas where cognitive deficits have been associated with lead toxicity, Ms. Harris performed well. Dr. Connolly states her score on the Category Test "is not within the significant range of dysfunction and would indicate neurocognitive resources for new problem solving, cognitive flexibility, mental efficiency, and set shifting." In other tests of frontal lobe functioning (including executive functioning which is also associated with deficits related to lead toxicity), she had scores within the normal range which supported the absence of any neurocognitive difficulties associated with the frontal lobes. (Of note, no validity tests are discussed to validate patient effort during the examination). Literature links chronic lead toxicity to neurocognitive impairment in areas of verbal memory, concentration, focus, and executive functioning skills (Shih, RA et al, 2006). Nevertheless, Ms. Harris scored well on these measures in her neuropsychological assessment. Thus, there is no clear evidence that these minor fluctuations in performance cannot be attributed to Ms. Harris's adjustment disorder with anxiety and depression, sleep disturbance, or longstanding hydrocephalus. There is no evidence in the literature that cognitive issues develop with lead levels of 3 µg/dL and her patterns of deficits do not meet those described in patients who suffer from cognitive issues related to higher levels of lead toxicity. It is more likely that her current complaints are related to the factors mentioned above, including depression and anxiety (worsened in the setting of COVID and national rioting as mentioned in therapy notes) and sleep disturbance which are not permanent disorders. Ms. Harris was also recommended cognitive retraining to help her with her current cognitive complaints which she has not undergone yet. Permanent disability cannot be presumed without undergoing treatment for these other related causes including continued psychotherapy and/or cognitive rehabilitation, with concomitant use of psychiatric medications, poor sleep management intervention, and recommended shunt therapy for her profound hydrocephalus. All of these untreated disorders can continue to worsen cognitive deficits and could be reversible with appropriate treatment.

In Dr. Wilkerson's expert report, he states that Ms. Harris suffered both a peripheral neuropathy and mild chronic encephalopathy (affecting calculation, memory, auditory and visual processing and organization requiring attention to detail) attributable to lead poisoning from retained shrapnel from her gunshot wound. He also stated that her cognitive impairment restricts her ability for successful employment at a level commensurate with her education and that she will need ongoing support to manage finances and other tasks of similar complexity. However, her education involved being home schooled with no history of any standardized testing. She does not have a formal high school diploma and did not complete education beyond the 12<sup>th</sup> grade. That said, she stated she did teach herself her IT skills and was reported to do well at work. It was stated in Dr. Shriner's notes on 11/2019 that she was doing well at work and was recently evaluated in the top 5% of her company, performing all job tasks without restrictions. In a note from J. Patrick Lincoln, Jr. LCSW, on 6/19/2020, he noted "work/employment going well, complimented on work ethics, performance." In Dr. Conolly's report in 8/2020, Ms. Harris stated she noted that she "does well on the job." She stated she has noticed some issues in the last six months, but "her employer is satisfied with her performance." In addition, formal neuropsychological testing demonstrated that she is "doing reasonably well in many cognitive areas," and that she scored in the 70<sup>th</sup> percentile on the working memory index of the WAIS-IV assessment of intelligence which assesses concentration, ability to retain information in memory, effectiveness in retaining information one hears, ability to focus listening ability, and capacity for auditory attentiveness and concentration. Thus, these facts and documented formal neuropsychological testing do not support evidence for Dr. Wilkerson's assessment. Dr. Wilkerson also stated in his report that Ms. Harris had no known history of prior focal or specific neurological deficits prior to the shooting which is inaccurate. She did have hip, neck, and back pain as well as headaches, right sided numbness and knee issues that predate the shooting. She was also going to a chiropractor prior to the shooting. Dr. Wilkerson stated Ms. Harris stated her prior Chiari malformation and hydrocephalus were asymptomatic but these

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complaints that predate the shooting provide evidence to suggest otherwise. In addition, it is important to note that her current motor and sensory deficits can be explained by her premorbid, untreated large cervicothoracic syrinx with diffuse hydrocephalus involving the entire ventricular system.

Finally, in regards to a recent Times article about Ms. Harris's experiences and diagnosis, it states: "On average, a healthy adult has a blood lead level of 2 micrograms per deciliter, according to Maddaloni, the former EPA toxicologist." While the World Health Organization says no level of lead exposure is considered safe, this is referring to pediatric exposure and the CDC recommends taking action when levels are above 5 micrograms per deciliter.

Ms. Harris has shown improvement in neuropathic symptoms and stability of those symptoms for over a year with the use of orthopedic devices and physical therapy. During this time, she has had stable blood lead levels between 2-3 µg/dL, despite cessation of chelation in 7/2019 and report of genetic abnormalities in metabolism pathways that could impair detoxification of toxins. Her symptoms of bilateral foot drop developed in 2/2018, prior to her lead levels being elevated, with a normal blood lead level tested in 6/2018 when Ms. Harris states her physical condition was at its worst. Thus, these findings suggest that the development of her bilateral foot drop could be related to her prior comorbidities of a Chiari malformation secondary to her untreated severe hydrocephalus as well as syringomyelia. She says her condition is mildly better today and that the chelator helped her achieve a little more functionality but this functional improvement also coincided with the use AFOs and a Bioness electric stimulant device as well as physical therapy. Again, supporting evidence for a deficit that is likely not related to blood lead levels. In addition, Ms. Harris also complains of cognitive issues which she relates to lead toxicity. However, her cognitive issues reportedly developed in 10/2019, ~7 months after the lead levels had been greatly reduced and stably measuring within normal limits. As noted above, the cognitive difficulties Ms. Harris is currently experiencing are likely more related to situational induced anxiety and depression (adjustment disorder), disrupted sleep due to premorbid hip pain, and longstanding hydrocephalus. All of these causes are treatable and reversible with appropriate treatment and thus, deeming these cognitive findings as permanent and related solely to lead toxicity has not been sufficiently supported by the evidence of this case. Taken all together, within a reasonable degree of medical probability, I do not believe that Ms. Harris's reported deficits were caused by her temporarily elevated blood lead levels that resulted from the shooting on November 5, 2017.

All my opinions are stated to a reasonable degree of medical certainty. I reserve the right to amend, supplement or change my expert opinions should further information and records become available during the course of discovery in this matter.

Very truly yours,



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1. Abbate C, Buceti R, Munao F, Giorgianni C, Ferreri G. Neurotoxicity induced by lead levels: an electrophysiological study. International Archives of Occupational and Environmental Health. 1995;66(6):389–392.
2. Bleecker ML, Ford DP, Vaughan CG, Lindgren KN, Tiburzi MJ, Walsh KS. Effect of lead exposure and ergonomic stressor on peripheral nerve function. Environ. Health Perspect. 2005b;113(12):1730–1734.
3. Botez MI, Ethier R, Léveillé J, Botez-Marquard T. A syndrome of early recognition of occult hydrocephalus and cerebral atrophy. Q J Med. 1977 Jul;46(183):365-80. PMID: 918252.
4. Centers for Disease Control and Prevention. Adult blood lead epidemiology and surveillance—United States, second and third quarters, 1998, and annual 1994–1997. MMWR Morb Mortal Weekly Rep 1999;48:213-6, 23.
5. Chan Time Magazine: The Poison in their Blood 2019 lead bullet.
6. Chuang HY, Schwartz J, Tsai SY, Lee ML, Wang JD, Hu H. 2000. Vibration perception thresholds in workers with long term exposure to lead. Occup Environ Med. 2000 Sep; 57(9):588-94.
7. Department of Labor (US), Occupational Safety and Health Administration. Final standard for occupational exposure to lead. Federal Register 1999;43:2952-3014.
8. Gaddy MA, Ingram RE. A meta-analytic review of mood-congruent implicit memory in depressed mood. Clinical Psychology Rev. 2014 Jul;34(5):402-16.
9. Hubbard NA, Hutchison JL, Hambrick DZ, Rypma B.J. The enduring effects of depressive thoughts on working memory. Affective Disorders. 2016 Jan 15;190:208-213.
10. Hubbard, N. A., Hutchison J. L., Turner, M., Montroy, J., Bowles, R. P., & Rypma B. Depressive thoughts limit working memory capacity in dysphoria. Cognition & Emotion. 2016;30(2):193-209.
11. Iddon JL, Morgan DJR, Loveday C, Sahakain BJ, Pickard JD (2004) Neuropsychological profile of young adults with spina bifida with or without hydrocephalus. J Neurol Neurosurg Psychiatr 75:1112–1118.
12. Iwata T, Yano E, Karita K, Dakeishi M, Murata K. Critical dose of lead affecting postural balance in workers. Am. J. Ind. Med. 2005;48(5):319–325.
13. Kosnet, MJ et al. 2007. Recommendations for Medical Management of Adult Lead Exposure. Environmental Health Perspectives. VOLUME 115 | NUMBER 3.
14. Krieg EF et al. 2005. The Relationship Between Blood Lead Levels and Neurobehavioral Test Performance in NHANES III and Related Occupational Studies. Public Health Reports / May–June 2005 / Volume 120:240-251.
15. Novegno F et al. (2008). The natural history of the Chiari Type I anomaly. J Neurosurg Pediatrics 2:179–187.
16. Panda AK & Manmeet K. 2013. Rapidly progressive foot drop: an uncommon and underappreciated cause of Chiari I malformation and holocord syrinx. BMJ Case Rep 2013. doi:10.1136/bcr-2013-009644.
17. Potential Health Risks to DOD Firing-Range Personnel from Recurrent Lead Exposure, Committee on Potential Health Risks from Recurrent Lead Exposure of DOD Firing-Range Personnel; Committee on Toxicology; Board on Environmental Studies and Toxicology; Division on Earth and Life Studies; National Research Council. Washington (DC): National Academies Press (US); 2012 Dec 3.
18. Shelton, D., & Kirwan, C. B. A possible negative influence of depression on the ability to overcome memory interference. Behavioural Brain Research. 2013,256: 20-26.
19. Shih RA et al. 2007. Cumulative Lead Dose and Cognitive Function in Adults: A Review of Studies That Measured Both Blood Lead and Bone Lead. Environ Health Perspect 115:483–492.
20. Schwartz BS, Lee BK, Lee GS, Stewart WF, Lee SS, Hwang KY, Ahn KD, Kim YB, Bolla KI, Simon D, Parsons PJ, Todd AC. 2001. Associations of blood lead, dimercaptosuccinic acid-chelatable lead, and tibia lead with neurobehavioral test scores in South Korean lead workers. Am. J. Epidemiol;153(5):453–464.

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21. Thomson RM & Parry GJ. (2006). Neuropathies associated with excessive exposure to lead. *Muscle Nerve* 33: 732–741.
22. Yakovlev PI. Paraplegias of hydrocephalics; a clinical note and interpretation. *Am J Ment Defic.* 1947 Apr;51(4):561-76.
23. Zimmermann-Tansella C et al (1983). Psychological and Physical Complaints of Subjects with Low Exposure to Lead. *Human Toxicology* 2, 615-623.